

Cleveland State University EngagedScholarship@CSU

Undergraduate Research Posters 2016

Undergraduate Research Posters

2016

Ground Reaction Force Measurement with a Piezoelectric Insole

Mohamad Khattab
Cleveland State University

Follow this and additional works at: https://engagedscholarship.csuohio.edu/u_poster_2016
How does access to this work benefit you? Let us know!

Recommended Citation

Khattab, Mohamad, "Ground Reaction Force Measurement with a Piezoelectric Insole" (2016). *Undergraduate Research Posters 2016*. 54.
https://engagedscholarship.csuohio.edu/u_poster_2016/54

This Book is brought to you for free and open access by the Undergraduate Research Posters at EngagedScholarship@CSU. It has been accepted for inclusion in Undergraduate Research Posters 2016 by an authorized administrator of EngagedScholarship@CSU. For more information, please contact library.es@csuohio.edu.



This digital edition was prepared by MSL Academic Endeavors, the imprint of the Michael Schwartz Library at Cleveland State University.

Ground Reaction Force Measurement with a Piezoelectric Insole

Washkewicz College of Engineering

Student Researcher: Mohamad Khattab

Faculty Advisor: Hanz Richter

Abstract

The objectives of this research project are to design and build an instrumented shoe to measure the vertical ground reaction force (GRF) associated with a person walking or running. Sensor outputs are calibrated to actual GRF with an artificial neural network.

Currently, GRF measurements require special equipment such as force plates or scientific treadmills. A force plate measures GRF over a limited area. A shoe insole fitted with sensors was identified as a good solution that allows free-range walking over arbitrary surfaces.

Piezoelectric film sensors were chosen due to their low cost, flexibility and for being self-powered. Eight sensors were bonded to a conventional insole and wires attached. A data acquisition interface was prepared using a dSPACE MicroLabBox system, which contained digital filters for noise removal.

Training and validation data were collected using a force-sensing treadmill available at the Parker-Hannifin Human Motion and Control Lab at CSU. A 3-layer feedforward network was successfully trained to approximate the training data. A separate data set was used to validate the trained network. A normalized root mean square error associated with training was 1.01, while the error in validation was 2.78.